CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

An electrolyte is a substance that produces an electrically conducting solution when dissolved in water. The electrolytes is widely use in electrical devices which include batteries, solar cell and supercapacitors for generating. Basically, electrolyte divided by three types, liquid electrolyte, gel electrolyte and solid electrolyte. Among these electrolytes, liquid based electrolyte has higher ionic conductivity and good in application but face with lots of limitation such as corrosion, leakage, reaction with electrode and some of it will explode thus very harmful to human and environment. On the other hand, gel electrolytes have unique properties which are easily to shaped, good mechanical properties, stable performance in applications and high conductivity compared to liquid electrolyte. However, gel electrolytes are very expensive in production and also due to their two phases of solid and liquid form, it hard to produce.

Solid electrolyte have an advantages to overcome the problem in liquid electrolyte and gel electrolyte. Solid electrolytes helps to eliminate corrosive solvent, harmful gas, thermal stability and also easy to fabricate with low cost production (Isa, et al., 2014). As world is stepping development technology, the user are need the long lasting, user friendly and low cost product.

Nowadays, the development of solid polymer electrolytes systems (SPEs) is active and its ionic conductivity have been improved by year. There are some properties in SPEs such as ease of fabrications including good contact between electrode and electrolyte, good mechanical and adhesive properties, no leakage electrolytes, higher in energy density and improved in safety hazards (Samsudin et al, 2014). However, there is an increment of polymers that based on petroleum sources especially synthetic polymer. All of these products, is hard to dispose, contribute to environmental pollutions that will cause harmful to human (Rudhziah et al, 2015).

In order to reduce the dependence of petroleum based polymer, the Solid Biopolymer electrolytes (SBEs) are introduced which have its interesting due to its economic, environmental friendly, nontoxic and abundant in nature. The example natural based polymer electrolytes include starch, chitosan, cellulose, soy based and sago (Hafiza and Isa., 2015).

1.2 PROBLEM STATEMENT

Polymer based electrolyte material have great interest due to their properties such as ease of preparation into films with large surface area. But, there are increasing the use synthetic polymer such as polyethylene oxide (PEO), polyethylene (PE) and polyvinyl alcohol/polyvinyl chloride (PVA/PVC) in polymer electrolytes. All of the synthetic polymer use is hard to dispose and harmful to human and also environment. In addition, the chemical used in is expensive because source from petroleum (Rudhziah et al., 2015).

In order to overcome the issues, the research on environmental friendly and low cost fabrication is essential to explore. Natural polymers are particularly interesting due to their properties in nature and biodegradable properties (Chai & Isa, 2015). Example of biopolymer are carboxymethyl cellulose, chitosan and starch (Samsudin et al, 2014). But, the single biopolymer is still lack of performance although the single polymer is adding by its dopant (Kadir et al., 2014). The conductivity is still lower for any electrochemical devices. Therefore, it will be affect the performance of electrochemical devices.

For that reason, in this research, the using of biopolymer from cellulose derivative namely carboxymethyl cellulose (CMC) and carrageenan derivative namely kappa-carrageenan (KC) were used and the using of blending technique is one of technique to overcome the performance of single polymer electrolytes system.

1.3 OBJECTIVES

In the present research, the objective based on:

1. To formulate solid biopolymer electrolytes thin film based CMC/kappa-carrageenan with different percentage.
2. To determine the structural properties of hybrid CMC/kappa-carrageenan solid biopolymer electrolytes (SBEs) system.
3. To determine the ionic conductivity of hybrid CMC/kappa-carrageenan solid biopolymer electrolytes (SBEs) system.

1.4 THESIS OUTLINE

In this research, the literature review were presented in Chapter 2 which focusing more on the structural studies and the conductivity studies about biopolymer electrolytes based on previous works. The materials and methodology of the research were discusses in Chapter 3. The hybrid biopolymer CMC/KC films were successfully prepared using casting method and were characterized by using Electrical Impedance spectroscopy (EIS), Fourier Transform Spectroscopy (FTIR) and X-ray Diffractometer (XRD).

The result obtained from the characterization were discussed in Chapter 4. In this chapter, it contain with two studies namely structure analysis and electrical analysis. For conclusion and recommendation, it was presented in Chapter 5 based on discussion in Chapter 4.